THE GLASS INDUSTRY

VOLUME 25, NUMBER 3, MARCH, 1944

The Value of Statistics

DRY as dust and tiring to the eye, statistics have never been viewed as anything but a necessary evil in the business scheme. However, a recent example in the glass manufacturing field of the value of gathering statistics would seem to refute all of the condemnation which has been heaped upon the statistician and his "boresome mental progeny" statistics.

For many years the manufacturers of machine made tumblers and those producing automatic machine made table and kitchen glassware have been compiling statistics on production and consumption of these types of glass products. In August, 1943, the Office of Civilian Requirements requested these manufacturers to estimate for the year 1943 the industrys' production and the possible requirements for this type of glassware.

Such estimates in peacetime would offer some difficulties but under wartime conditions, with its attendant problems of labor, materials, supplies and transportation, the difficulty of accurate estimating is increased ten-fold. Exemplifying wartime variables was the necessity of a completely revised estimate for automatic machine made table and kitchen glassware made necessary three months after the original estimate, by WPB corrugated box order L-317 restricting the use of this type of ware.

Despite the strong possibility of wide variations between prophecy and performance the glass manufacturers did submit estimates of production and consumer requirements to the OCR through its organization the American Glassware Association.

A recent appraisal of the estimates made in these two divisions of the glass industry has disclosed not only the amazing accuracy of the Association's prognostications but dramatically reveals the importance and desirability of careful statistical endeavor—particularly advantageous in periods of emergency.

In the automatic machine made table and kitchen glassware field, exclusive of heat-resisting-ware the following figures indicate the closeness with which production and requirements were estimated, the accuracy of which was made possible only through the accumulation of many years of factual satistics.

	Estimate August 18	Revised Est. October 14*	Actual	% of Error
Requirements	66,200,000	66,200,000	64,240,000	3.0%
Production	50,100,000	41,800,000	41,756,000	.001%

* Estimates were revised after the WPB Order L-317 restricting cartons for glass table and kitchenware was issued. (All figures in dozens)

Closely paralleling this estimating job is the one relating to machine made glass tumblers and it may be of interest to note that a primary purpose of this survey was for its use by the War Manpower Commission in connection with the industry's request that it be declared essential.

As a matter of record it should be noted that there was a total of about 62,400,00 dozen automatic machine made tumblers shipped during 1943, the difference in production and shipments coming out of inventory. Figures showing estimates and accomplishment for this division of the glass industry are as follows:

	Estimate	Actual	% of Error
Requirements	77,500,000 doz.	75,301,000 doz.	2.8%
Production	59,160,000 doz.	61,693,000 doz.	4.3%

Unusual as would have been the accuracy of these estimates under normal conditions, the very low percentage of error, in spite of wartime contingencies makes these estimates, we feel, worthy of special comment. Remarkable not only because of their surprising dependability but also as an outstanding example of the *value of statistics.*

A PRECISION APPARATUS FOR THE RAPID DETERMINATION OF INDICES OF REFRACTION AND DISPERSION BY IMMERSION

By CONRAD A. FAICK and BERNARD FONOROFF

In the production of optical glass, careful control over the optical properties, especially the index of refraction (n_D) and the Abbe value (ν), of the product is essential. Most methods for measuring indices of refraction are sufficiently accurate for the control of the n_D value. The ν value, on the other hand, presents a special problem in index measurement. It is defined as $(n_D-1)/(n_F-n_C)$ and in order to determine this value within certain specified limits, the index of refraction must be measured very accurately. Some typical tolerances which have to be met and the errors in the index measurements corresponding to these tolerances are shown in Table 1.

It is obvious from Table 1 that the required accuracy of index measurements is determined mainly by the ν value tolerances. If the errors in index measurements are as great as those listed in column 3, the ν values may be in error by the amount of the permissible tolerances. In order to be certain that the ν values are well within the required limits, the best spectrometer measurements[1] are necessary for final control of crown glasses, and are desirable for flint glasses. However, there are many useful routine checks and measurements which can be made on refractometers.

In normal times at the optical glass plant of the National Bureau of Standards the problem of control was solved by making two independent sets of measurements. The immersion method of Faick and Finn[2] was used for immediate production control work.

The method consists essentially of matching the index of refraction of the glass with that of a suitable liquid in which the sample is immersed and then measuring the index of the liquid. The apparatus consists of a telescope and a grid, illuminated by a sodium light, which are placed on opposite sides of a water-cooled tank containing the immersion liquid and sample. The match between the glass and the liquid is obtained by altering the index of the liquid until no distortion of the grid pattern is observed through the telescope. Accuracies within $\pm 3 \times 10^{-4}$ are obtainable with this method. The final and more accurate values of the optical constants were later measured on a spectrometer and precision refractometer.

TABLE I

Typical tolerances for n_D and "ν" values.

Glass	*Typical values and tolerances*		*Error corresponding to tolerance in ν*
	n_D	ν	
Borosilicate Crown	1.517 ± 0.001	64.5 ± 0.3	$\pm 2 \times 10^{-5}$
Light Barium Crown	1.572 ± 0.001	57.4 ± 0.3	$\pm 3 \times 10^{-5}$
Dense Flint	1.649 ± 0.0015	33.8 ± 0.3	$\pm 9 \times 10^{-5}$

During wartime manufacturers are called upon to make new glasses and a greater variety of them. This requires frequent changes in batch compositions and makes necessary more frequent and careful determination of index of refraction and dispersions. Under these conditions the above-mentioned immersion control method was deficient both as to speed and accuracy. The more accurate index measurements as they are generally made, on spectrometers or on carefully calibrated Pulfrich refractometers, require ground and pitch-polished samples. The time-consuming operations of grinding and polishing cause delay in the processing of the glass or in the revision of batch compositions, especially in glass plants that are not equipped with grinding and polishing facilities for the preparation of samples. Most immersion methods permit the use of rough, unprepared samples, but either do not yield sufficiently accurate results or lack the simplicity and speed desired.[3] It was, therefore, felt desirable to develop an immersion method for rough samples which would have the required accuracy and permit speed and ease of manipulation.

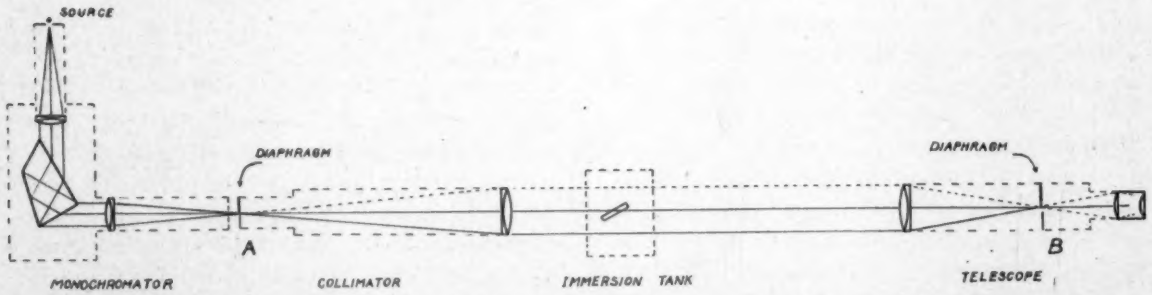

Fig. 1. The schematic drawing of the optical system for matching the indices of the glass and immersion liquid.

Method of Matching

One of the chief requirements of immersion refractometry is a sensitive method for ascertaining the match between the indices of the sample and immersion liquid. Of the various methods that could be used for this, one embodying the principles of oblique illumination, well known to petrographers, seemed the most promising both for sensitivity and simplicity of operation. A system of oblique illumination, using double diaphragms, has been described by Saylor[4] and shown to be superior to usual methods, at least when used on a microscope. Another double-diaphragm method, employing a telescope and a long focus lens as parts of the optical system, has been used by Cheshire[5] for measuring the index of refraction of glass by immersion. This system is too cumbersome for rapid control work.

Basically, the method finally chosen consists of inserting at the focus of a condensing lens (Fig. 1, A) a diaphragm which shades out almost one-half of the beam of light. The emerging beam is then passed through the immersion liquid and again brought to a focus by means of a second converging lens. At this focus (Fig. 1, B) a second diaphragm is placed so that most of the remaining bright portion of the beam is shaded out. If a telescope is then inserted in the system, the field, as seen through the eyepiece, will appear dimly but uniformly lighted. Now, when a specimen is immersed in a liquid of the same index of refraction as that of the specimen, the light rays passing through the specimen will not be deviated and, since the second diaphragm takes out the bright portion of the beam, the sample will be practically invisible against the dimly lighted field seen through the eyepiece (Fig. 2, B). However, if the match between the sample and liquid is altered, the path of light passing through the sample will be deviated so that the sample no longer blends with the field, but becomes light on one side and dark on the other. When the index of the immersion liquid is greater than that of the glass, the side of the sample (as seen through the telescope) that is on the same side as the diaphragms will be light (Fig. 2, A); when the index of the liquid is lower, the opposite side of the sample will be light (Fig. 2, C). By altering the index of refraction of the immersion liquid, which is a mixture of two liquids, one of a low and the other of a high refractive index, the match between the specimen and immersion medium can be easily established. After a match has been obtained, the index of refraction of the liquid is measured on a precision refractometer by comparison with a standard of approximately the same index.

Apparatus

The apparatus (Figs. 1 and 3) consists essentially of light sources, a monochromator with the exit slit removed, a collimator, an immersion tank, a telescope, a tested precision refractometer, and accessory equipment. Referring to Figure 1, the light from the source is first passed through a monochromator,[6] where a particular spectrum line is isolated and is brought to a focus at the end of the collimator where the first diaphragm is placed. This diaphragm is an adjustable knife edge that covers part of a circular opening, replacing the usual collimator slit. The light then passes through the collimator, from which it emerges as a parallel beam (or a very slightly converging one) which passes through the tank and then enters the telescope. Near the focal plane, the second diaphragm, which is also adjustable, is located. The objective is selected so that in combination with the eyepiece it forms a telescope that can be focused on the sample in the immersion tank at a distance which is convenient for the operator. As an added convenience, the telescope is fitted with a right angle prism and mounted in a vertical position.

Fig. 2. Field through the eyepiece of the telescope—diaphragm on right side of the instrument. (A) When the index of the liquid is greater than the index of the sample. (B) When the liquid and sample have the same index. (C) When the index of the liquid is lower than that of the sample.

The light sources used are a sodium vapor lamp and a hydrogen discharge tube. They are mounted on a sliding support to facilitate changing from one to the other (Fig. 3).

The immersion tank is equipped with plate glass windows and a water jacket for temperature control. The water jackets of this tank and of the refractometer are connected in parallel and water from the same source is circulated through both. The accessory equipment includes a water reservoir and circulating pump, a motorized stirrer for mixing the immersion liquids, thermometers[7] in the immersion tank and refractometer, and a vacuum pump and a hydrogen generator for frequent refilling of the discharge tube.

Procedure

Six immersion liquids were prepared. The indices of refraction of these liquids were approximately 1.517, 1.572, 1.604, 1.617, 1.620 and 1.649, respectively. The first five liquids were mixtures of liquid petrolatum ($n_D = 1.456$) and α—chloronaphthalene ($n_D = 1.632$).

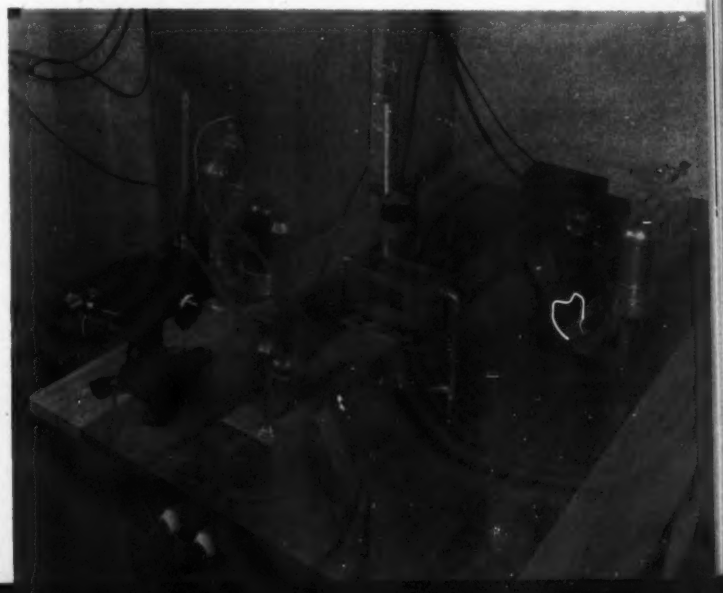

Fig. 3. Complete immersion apparatus.

The sixth liquid was a mixture of α—chloronaphthalene and α—bromonaphthalene ($n_D = 1.656$). After isolating a particular spectrum line by means of the monochromator, the sample was immersed in the appropriate liquid, and the two were matched for index by adding small quantities of one of the pure liquids. When a good match had been obtained, the index of the immersion liquid was measured on the refractometer. This process was repeated four times for each sample. In each series of measurements, care was taken to approach the correct value from both a higher index immersion liquid and a lower one. Measurements of the temperature of the immersion liquid and of the refractometer prism block were made with a precision of ±0.02° C. Corrections for very small temperature differences were applied by using an average change of —0.00035 in index per degree rise in temperature.

In order to obtain the highest possible accuracy in index measurements, a comparison method, as recommended by Tilton,[8] was used. By this method, instrumental errors, such as a shift in the zero setting, can be readily compensated. Essentially this method consists in checking the refractometer, before and after each series of immersion measurements, with a standard of known index approximately the same as the rough sample being measured and making the necessary corrections. This check was made for each type of glass and for each wave length used, by measuring the standard as a Pulfrich slab on the refractometer. In several cases brought to the attention of the authors considerable difference was found in the readings of refractometers when measuring solid and liquid samples of the same index. Should this be the case, an alternative procedure should be used in checking the refractometer. In the alternative procedure a liquid which in each case is matched with a known sample in index is used as the "standard" instead of the solid sample.

A series of 12 glass samples was tested to obtain the accuracy of the instrument. These standards were cut from prisms that had been previously measured on a spectrometer. The indices of refraction of these test pieces were known to the fifth decimal place. Since these samples were in the shape of rectangular prisms approximately 2 by 2 by 0.2 cm in size and had polished faces, and since the instrument was designed for measuring rough, irregularly shaped specimens, it was necessary to compare the accuracies of measurement obtainable with rough pieces and finished samples. This was done by measuring the indices of refraction of four rough pieces of glass and then grinding these pieces to the same shape as the standards and then remeasuring the indices. The results of this test show that any difference that does exist is within the error of measurement.

Results

The values obtained in the test of the rough blanks are given in Table 2. A total of 48 measurements were made on the 12 regular samples for each of the wave lengths, corresponding to the sodium D line, and hydrogen F and C lines. The results of these measurements are tabulated in Table 3 (see page 126). Table 3 also shows the errors in the measured values as compared with the spectrometer values. An examination of these errors shows that the maximum error, or degree of accuracy, for any single measurement is $\pm 5 \times 10^{-5}$, but the average error for the 144 measurements is only $\pm 1.9 \times 10^{-5}$. The reproducibility, or precision, of these measurements, expressed as the average of the deviations from the mean value of each set of four immersion measurements, is $\pm 1.5 \times 10^{-5}$.

A summary of the average accuracy and precision of all determinations is given in Table 4.

TABLE 2

Comparison of measurements made on rough, irregularly shaped samples and fine-ground, rectangular specimens.

	Index of refraction (n_D)	
	Sample I	
	Rough sample	*Ground sample*
1	1.51580	1.51578
2	1.51582	1.51581
3	1.51578	1.51583
4	1.51585	1.51580
Avg	1.51581	1.51581
	Sample II	
1	1.57187	1.57188
2	1.57189	1.57187
3	1.57190	1.57186
4	1.57188	1.57190
Avg	1.57189	1.57188
	Sample III	
1	1.60179	1.60178
2	1.60182	1.60180
3	1.60180	1.60180
4	1.60184	1.60181
Avg	1.60181	1.60180
	Sample IV	
1	1.61960	1.61960
2	1.61961	1.61963
3	1.61963	1.61961
4	1.61962	1.61962
Avg	1.61962	1.61962

TABLE 4

Summary of accuracy and precision of determinations listed in Table 3.

	Average error	*Average deviation from mean values*
n_D	1.6×10^{-5}	1.4×10^{-5}
n_F	2.1×10^{-5}	1.6×10^{-5}
n_C	2.1×10^{-5}	1.6×10^{-5}
All values	1.9×10^{-5}	1.5×10^{-5}

The accuracy attained in these measurements is almost as high as the precision attainable on a refractometer. This indicates that the error introduced in determining the match between the indices of the glass and liquid are for the most part negligible. According to Tilton[9] it would be very difficult to obtain results of this accuracy without the use of a comparison or substitution method. The success attained may be largely attributed to the fact that in measuring a known stand-

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Glasshouse Friggers

Bugles and Bells

By T. TAYLOR SEAGO

What clearer notes can man recall
  Than those of bugle and of bell
The schoolroom's tintinnabulary call
  Lingers on through the years full well,
And the bugle's sharp, insistent note
  Calls men to battle far and near:
Imagine these of glassware wrought,
  —How pure the sound—how *crystal clear*.

The two friggers shown in the illustration have been featured together because they are similarly wrought and because they both produce musical sounds.

The bugle shown here is in the possession of Mr. H. Kay, of Hoyland Common, Yorkshire, and the writer has heard him blow a magnificent sonorous note upon this very instrument. It gives forth an immense volume of sound for such a comparatively small piece—it is only 10 ins. long and the trumpet flare is 2½ ins. in diameter. It is particularly pleasing in appearance, being strongly twisted throughout its length, and of a lovely nickel-purple lead-crystal glass.

These instrumental "friggers" were made in the following way. When the requisite amount of molten-glass had been gathered, the mouthpiece would first be made, after blowing and elongating the gathering. This end would then be stuck up on a pontil and the "ball" end detached from the gathering iron. This ball would be opened out by re-heating and so on, to form the flare of the bugle. The bending to form the handle would be completed by warming-in at the correct point, and the complete frigger would now be sent into the annealing kiln, or lehr.

Glass bells are made in three parts, the body of the bell, the handle and the clapper. The narrow, open end of the body, to admit the handle, is first made. After sticking this end on a pontil the glass ball which the blower has made is warmed in at the pot mouth and the body of the bell is shaped and flared. The handle is made from a solid gathering, shaped by simple tools whilst attached to the gathering iron, and after annealing, is fastened into the bell itself by means of plaster of paris. Into this latter preparation is mounted a thin loop of wire. This is provided to form a means of support for the glass clapper, one end of which takes the form of a hook so that it may be suspended from the wire mentioned above.

The bell depicted here was made by the late James Henderson, of Barnsley: it is gold ruby glass, with a clear white flint handle. The body of the bell has an "optic" finish, that is to say, the molten gathering has been dipped into a fluted iron cup or mould before final blowing, to give an internal ribbed appearance. It is 10 inches high and measures 5 inches diameter across the flare.

Many color combinations have been employed in the making of these friggers and a multitude of shapes have been produced. The bell shown, however, is of extremely graceful proportions and the handle is a particularly well-conceived unit.

For the sake of clarity, the glass clapper is shown by the side of the bell in the illustration.

A. C. S. MEETING AGAIN IN PITTSBURGH

The forty-sixth Annual Meeting of the American Ceramic Society, for the second successive year, will be held in Pittsburgh, with headquarters at the William Penn Hotel. The meeting will officially start Sunday, April 2nd, and continue through Wednesday the 5th.

According to information released by the Society, over 700 members have made badge reservations for the meeting which is designated as the "second war conference." From the titles of discussions listed, including an address by Major Albert J. Stowe, Military Intelligence Division, War Department, for the War Conference General Session program the war aspect of the convention is strongly evident. Following is the list of papers comprising the general session which is scheduled for Monday the 3rd.

Wage Incentive. *By James Finney Lincoln, Lincoln Electric Co., Cleveland, Ohio.*

Wage Incentive. *By D. T. Sterling, D. T. Sterling Co., Stamford, Conn.*

Postwar Enamel Industry. *By Robert A. Weaver, Ferro Enamel Corporation, Cleveland, Ohio.*

Postwar Housing. *By I. W. Clark, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.*

Industrial Design and Creative Postwar Thinking in the Glass, Clay, and Enamel Industries. *By J. Gordon Lippincott, Dohner & Lippincott, New York, N. Y.*

Chemistry in Defense and Recovery. *By Edward Weidlein, Director, Mellon Institute, Pittsburgh, Pa.*

Industry Prepares for Peace. *By John A. Stephens, U. S. Steel Corp., Pittsburgh, Pa.*

Under today's conditions, time being of the essence and with the ever increasing difficulties of transportation, the convention period has again been limited to four days. Notwithstanding this time curtailment and other problems, a full and interesting program for the Glass Division has been developed by K. C. Lyon, Chairman of the Papers and Program Committee of the Division.

As a change of pace during the two days allotted for technical papers and discussions there will be a review session for Hand Plant Operators scheduled for Tuesday afternoon and two simultaneous sections to be held Wednesday morning. One of these section meetings will be devoted to Glass Furnace Operation, while the other will be a symposium on Optical Glass. In connection with the glass furnace section a Round Table Discussion has been planned with the following individuals promising their cooperation in this activity: A. W. Dodge, Hazel-Atlas Glass Company; W. W. Oakley, Corning Glass Works; and J. W. Wright, Owens-Illinois Glass Company.

Unfortunately brief summaries of the various papers developed for the Glass Division are unavailable as this issue goes to press. However, a complete list of the papers now scheduled follows:

Glass in the Electronics Industry. *By H. C. Steiner, General Electric Co., Schenectady, N. Y.*

Effect of Fluorine and Phosphorous Pentoxide on Certain Physical and Chemical Properties of Glass. *By Owens-Illinois Research Laboratory, Owens-Illinois Glass Co., Toledo, Ohio.*

Effects of Fluorides on Glass. *By Paul N. Corbett, Pennsylvania Salt Manufacturing Company, Philadelphia, Pa.*

Properties of Some VYCOR Brand Glasses. *By M. E. Nordberg, Corning Glass Works, Corning, N. Y.*

Surface Tension and the Persistence of Cords in Glass. *By Mellen A. Knight, Preston Laboratories, Butler, Pa.*

Glass Stones. *By W. L. Fabianic, Owens-Illinois Glass Co., Alton, Ill.*

HAND PLANT SESSION

Cords. *By L. G. Ghering, Preston Laboratories, Butler, Pa.*

Decolorizing Pot Glass. *By S. R. Scholes, New York State College of Ceramics, Alfred, N. Y.*

Suggestions Concerning Pots in Hand Plants. *By Axel Ottoson and C. J. Uhrmann, Imperial Glass Corp., Bellaire, Ohio.*

American Society for Testing Materials. *Sub-Committee of C-14 on Glass and Glass Products.*

SYMPOSIUM ON OPTICAL GLASS

Light Absorption of Iron in Various Base Glasses. *By W. A. Weyl, Scientific Director, Glass Science, Inc.*

Some Chemical Reactions of the Surface of Optical Glass. *By H. C. Hafner and N. J. Kreidl, Bausch & Lomb Optical Co., Rochester, N. Y.*

Deterioration of Glass in Tropical Use. *By Frank Jones, Bausch & Lomb Optical Co., Rochester, N. Y.*

A Precision Apparatus for the Rapid Determination of Indices of Refraction and Dispersion by Immersion. *By Conrad A. Faick and Bernard Fonoroff, National Bureau of Standards, Washington, D. C.*

Variations of Refractive Index of Glass in the Annealing Region. *By Harold McMaster, Libbey-Owens-Ford Glass Co., Rossford, Ohio.*

Non-Reflecting Films. *By Frank Jones, Bausch & Lomb Optical Co., Rochester, N. Y.*

The Time Problem in Annealing. *By Mrs. A. Winter, Ecole Libre des Hautes Etudes, New York, N. Y.*

Optical Glass from the Viewpoint of the Lens Designer. *By R. Kingslake, Eastman Kodak Co., Rochester, N. Y.*

GLASS FURNACE OPERATION

Some Observations on Fuel Oil Consumption in Similar Container Glass Melting Furnaces. *By K. C. Lyon, Armstrong Cork Co., Millville, N. J.*

Value of Automatic Combustion Control and Its Effect on Design and Operation of Furnaces. *By E. G. Smith, Amsler-Morton Co., Pittsburgh, Pa.*

Application and Results in the Use of Automatic Control in Glass-Melting Furnaces. *By W. H. Hasselbach, Libbey-Owens-Ford Glass Co., Toledo, Ohio and F. E. Early, Askania Regulator Co., Chicago, Ill.*

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GLASS SCIENCE, INC.

Last August, as was reported in THE GLASS INDUSTRY, a group of manufacturers interested in the development and use of glass met with Dr. W. A. Weyl in New York City for the purpose of selecting an organizing committee to prepare a charter for a new glass institute.

The original sponsors of this new institute whose representatives attended the meeting were the Eastman Kodak Company, Corning Glass Works, Bausch & Lomb Optical Company, American Optical Company and the Pittsburgh Plate Glass Company.

While the detailed plans of organization and activities are yet to be worked out, THE GLASS INDUSTRY is now in a position to report that papers of incorporation for Glass Science, Inc., have been drawn up and filed in the State of New York and a set of by-laws for the institute have been evolved. It may also be recorded that the representatives of the same concerns originally sponsoring the idea are the incorporators and that Dr. Woldemar A. Weyl, for a number of years Professor of Glass Technology at Pennsylvania State College, has been appointed Scientific Director of Glass Science, Inc.

Although the papers of incorporation state that the office of Glass Science, Inc., is to be located in the City of New York it is understood that at least for the duration of the war headquarters will be maintained at Pennsylvania State College and that Dr. Weyl will continue as Professor of Glass Technology on a part-time basis. It is important to note, however, that Glass Science, Inc., is an independent organization and that a rent will be paid to the College for laboratory use and other facilities which may be made available.

Although a complete roster of the officers of Glass Science, Inc., is unavailable as this issue goes to press, the names of the following individuals appear in the papers of incorporation as directors of the new organization: Carl L. Bausch (Bausch & Lomb Optical Co.); Robert L. Clause (Pittsburgh Plate Glass Co.); Charles D. LaFollette (Corning Glass Works); C. E. Kenneth Mees (Eastman Kodak Co.); George B. Wells (American Optical Co.)

Of primary interest to the glass fraternity and its allied industries will be the aims and purposes of Glass Science, Inc., and a resume of the rules under which it will operate as contained in its by-laws.

Space limitations prevent publication in full of all the details relating to its organization and regulations. The following highlights, however, should serve to give a fairly clear picture of the functions and purposes of the organization.

It should be stated at the outset that Glass Science, Inc., is a scientific research group organized to engage in fundamental research in glass for the benefit of its members, industry and the general public. Its activities will be of a strictly scientific and educational nature and it will operate, as its papers state, "not for pecuniary profit."

Another matter which should be of considerable interest to the glass industry is the attitude of the institute with regard to the possible acquisition of patents. This attitude is probably best outlined by the following statement relating to patents which appears in the official papers of incorporation.

"It is not the purpose of the corporation to develop, own, acquire, or deal in patents or patent rights except as such activities, ownership, or transactions may be reasonably incidental to its main purpose.

"In recognition of the foregoing, it shall be the policy and practice of the corporation if patent rights are acquired and held to administer such rights on a basis of reasonable equality as regards the members, industry, and the public.

"Consistent with the foregoing, the corporation will grant non-exclusive licenses to sustaining and subscribing members and to all applicants on terms which, in the discretion of the board of directors, give full effect to the foregoing, provided that the board of directors may take into account dues and assessments paid and expenses incurred by members in connection with the organization and activities of the corporation and any other factor or factors regarded by the board of directors as pertinent to equitable administration of patent rights.

"In general, income from patents or the exercise of patent rights shall be used to further the primary purpose of the corporation, namely, research in glass and related and substitute materials, and shall in no event be distributed to members; provided that this shall not preclude the board of directors from making equitable provision for credit of royalties payable against dues, assessments, and other financial contributions paid or made by members."

The by-laws of Glass Science, Inc., comprised of ten Articles and twenty-six Sections, are of course too voluminous for publication in full in this account and much of this data would be of little or no interest to the general reader. However, certain sections of this information will reveal the structure of the society and the proposed rules under which it will operate.

There are to be four classes of membership available in Glass Science, Inc., and the various types of membership, together with qualifications and rules governing election, are stated in the by-laws as follows:

"*Classes of Members.* There shall be the following classes of members:

"(a) *Sustaining Members,* who shall not be natural persons, but who shall be any enterprise engaged in manufacturing, using, or selling any glass, ceramic, or related product, as well as other materials which may or might be used in place of or as substitutes for any or all of the foregoing.

"(b) *Subscribing Members,* whose qualifications shall be the same as those of sustaining members.

"(c) *Representative Members,* who shall be natural persons only and who shall in every case be an officer, director, trustee, employee, or partner of a sustaining member or a subscribing member.

"(d) *Associate Members,* who shall be natural per-

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SAFETY GOGGLES . . .

corrective as well as protective

Thousands of safety goggle lenses are being produced by The American Optical Company to meet the enormous demands of wartime production. Lenses ground to prescription to correct defective eyesight can also be toughened, thereby serving a dual purpose.

Many thousands of eyes are saved each year by toughened safety goggle lenses which resist the impact of flying objects often encountered in industrial operations. One person can operate two machines, such as the type shown, which temper lenses by a scientifically controlled heating-chilling operation. In the foreground are lenses held by rotating arms which carry them through an electric furnace. Approximately 8,000 lenses can be produced per day by one operator.

This machinist, employed by The American Optical Company, protects his eyes by wearing safety goggles whose lenses are toughened to ward off flying chips of metal.

Safety goggle lenses ground to prescription to correct defective eyesight can also be toughened. Illustrated is a special heating-chilling machine which tempers a prescription safety lens so that it resists breakage.

An inspector tests the lenses by attempting to break them. Through the pipe shown at the right, a 5/8 inch steel ball weighing a little over a half ounce is dropped on each lens from a height of six feet. The lenses must survive this extraordinary test.

INVENTIONS AND INVENTORS

Summary of United States Patents of Interest to the Glass Industry Issued During January

Compositions

To prepare a glass solution which can be applied to metal by spraying or dipping and later hardened by fusing, R. N. Wenzel of Swissvale, Pa., has found that lead borate glasses may be dissolved in polyhydric alcohols such as glycerine and ethylene glycol. He prepares the glass or even the constituent oxides of boron and lead by grinding them to 100 mesh or finer and then dissolves them in alcohol by heating and stirring. This patent is 2,333,608.* Both it and another Wenzel patent on similar subject matter, 2,308,409, granted in 1940, were assigned to Westinghouse Electric & Mfg. Co.

Research men of Corning Glass Works continue to add patents to the already sizeable group which covers their discovery that glass articles of very high silica content could be produced by forming the products from more alkaline glass of carefully chosen composition, heating to separate two glass phases within the article, leaching to remove the more alkaline phase, and finally heating the article to shrink it by closing out the pores left by the leaching. Some time ago one patent of this group showed how the glass could be colored by immersing the leached porous article in a bath of coloring salts before the final shrinking heat treatment. Now M. E. Nordberg and H. E. Rumenapp of Corning, N. Y., report in patent 2,340,013 that to prevent the development of opacity in an otherwise transparent glass, when an excess of the coloring salts are used, they introduce an aluminum salt, such as the nitrate, into the bath of salts.

A. J. Deyrup of Westfield, N. J., (E. I. du Pont de Nemours & Co.) received patent 2,338,099 for alkali-resistant glazes to be applied in decorating milk bottles and other glass containers. He mentions that the lead silicate and borosilicate glazes normally used are deficient in this property, which is so essential in ware cleaned frequently by alkaline detergents. Deyrup's new compositions may be summarized as follows:

	Per cent
Lead oxide	35 to 55
Silica	25 to 40
Zirconium dioxide	1 to 9
Alkali metal fluorides	1 to 9
Alkali metal oxides	0 to 5
Boric oxide	0 to 10

The fluorides and oxides of alkali metals referred to are those of lithium, sodium or potassium. The patent gives detail on sixteen different compositions falling within the above range of composition. A prior Deyrup patent on similar glazes was 2,278,868.

Feeding, Forming and Shaping

Henry H. Blau's patent 2,339,975 (Corning Glass Works) tells of several methods of producing differential opacity in glass articles, with such aims as that of developing an opaque design on a less opaque piece of ware. He refers to his earlier patent 2,132,390 in which he showed that the nuclei of the opacifying inclusions are formed in a certain temperature range, but that a higher temperature is required to cause these nuclei to grow and form complete opacification of the ware. In one method of operating under his newest patent, Blau forms an article from a suitably chosen glass, contacts the design portion with metal to cool it to the muclei forming range, while holding the remainder above this range, and then he heats the cooled section to the range in which the nuclei grow to fully opacify the design.

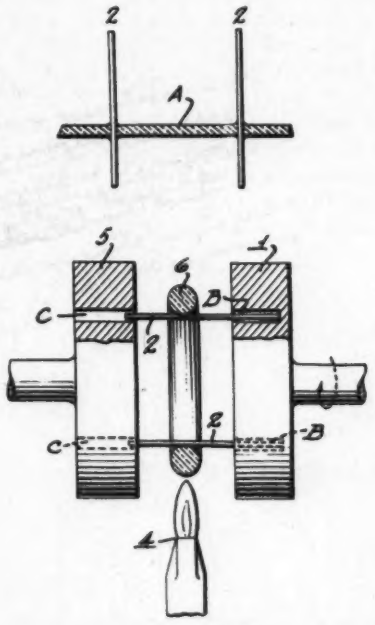

Fig. 1. 2,338,381: Lohmann. The seal of metal leads into a glass disc shown in upper drawing is produced by heating a ring of glass and then pressing it around the leads by dies 1 and 5.

Eugene Schwarz of Alexandria, Ind., (The Mantle Lamp Co. of America) who received patent 2,333,746 in November for a method of making lamp pedestals, has now received patent 2,338,269 for an additional contribution to this art. The newest patent is concerned with the production of such wares as lamp chimneys and bases on a continuous machine by pressing and blowing operations.

Miscellaneous Processes:

Russell A. Gulick of Lynnfield, Mass., has assigned to Stator Corp. his patent 2,339,221 for a method of uniting double walled nested containers, such as are used as food

*Issued in November 1943.

containers, ice pails, etc. One container is nested in another, a suitable sealing compound is applied at the joint, and the air pressure outside is maintained above that between the containers to force the sealing material into place. There are a number of ways of accomplishing this. The differential pressure can be established by heating the outer container before bringing it into place so the escape of expanding air will rarify the atmosphere between the two sections. A ring may be used temporarily to hold the sealing material in place until it is drawn into the joint.

Fig. 1 shows the method reviewed in patent 2,338,381 for forming electron tube bases consisting of a glass disc through which the lead-in wires are sealed. The upper view shows the finished article, a glass disc A, and leads, 2. Its formation is illustrated in the lower view which shows the leads in place between steel dies, 1 and 5. The glass for forming the disc is supplied as a ring 6, assembled around the leads. This form of blank is readily heated to softening by the flame as the burner or mould assembly is rotated. When this occurs the dies are brought together to flatten the ring of glass into a disc and to seal the leads into place. This is the invention of Franz Lohmann of Hamburg, Germany, and the patent is offered for free licensing by the Alien Property Custodian.

Another angle of the glass-to-metal seal problem is dealt with in patent 2,338,538 issued to Hans Pulfrich and Richard Magner of Berlin, and assigned to General Electric Co. To improve the adherence of glass to iron, he applies a coating of cobalt or molybdenum to the iron, preferably by electrolytic deposition, and then heats the coated article to alloy these metals with the iron at 1,000 to 1,400 degrees C.

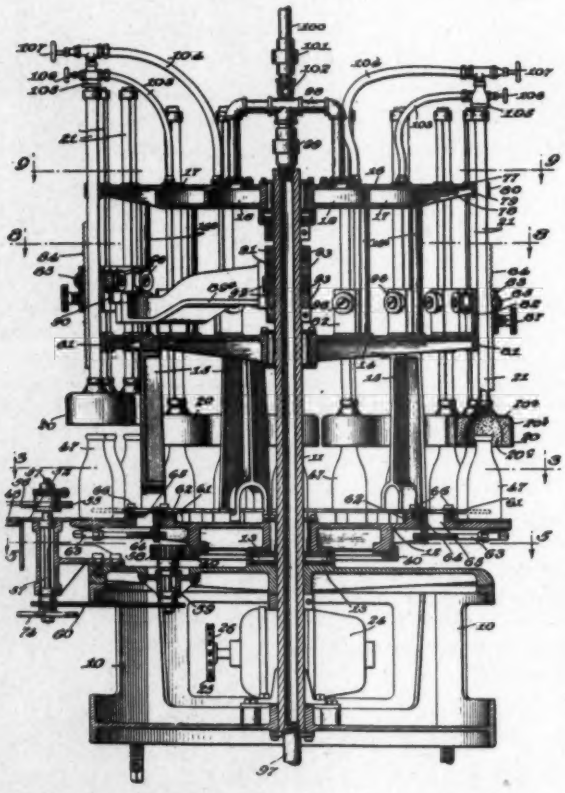

Fig. 2. 2,338,841: Fedorchak. Rotary machine for fire polishing the tops of bottles

Owens-Illinois Glass Co. patents include 2,338,852 to John Hohl and Olav Bjering for a machine for tightening caps on containers, and 2,338,841 to W. J. Fedorchak, A. S. Jackson, F. A. McCormick, C. A. Heyne, and H. E. Nelson for a fire polishing machine for polishing the lips or finishes of glass bottles, jars, etc. Fig. 2 shows one view of the latter machine in operation on milk bottles. It is a rotary machine with transfer devices for receiving bottles from the forming machine, rotating them while subjecting their tops to flame heating, and finally discharging them to a conveyor. In this illustration the burner head 20 at the right, is sectioned to show its construction. As in all fire polishing operations, the heat should be sufficiently intense to soften or melt a surface layer of the glass before much of the heat has time to penetrate the glass to any considerable depth. By thus confining the heat mainly to the glass surface all fine cracks, fissures, fins, seams or other irregularities can be smoothed out and eliminated.

Patent 2,338,176 issued to W. F. Goepfert of Weehawken, N. J. (Interchemical Corp.), covers a glass-marking pencil made from fatty acids, a resin, a hard vegetable wax, mineral oil or lard, and pigments and fillers.

Franz Skaupy and Gustav Weissenberg of Berlin, Germany, were the inventors in the A.P.C. vested patent 2,338,463 concerning the preparation of silica filaments by first starting with a filament of a base-plus-silica compound, then treating with an acid to remove the base and leave only silicic acid.

Lens coatings to reduce light reflection are discussed in three patents issued to G. L. Dimmich of R.C.A. (2,338,233; 2,338,234, and 2,338,497.) The first claims an optical element having a coating comprising the evaporation product of a mixture of calcium fluoride and alumina. The second patent provides a photo-electric control method for stopping the deposition of fluorides when the coating has reached the exact thickness desired. A light beam is directed through the bell jar in which the lens is being treated, so that it falls upon a glass surface and is reflected to a photo-electric cell which controls the current producing the evaporation of the fluorides to coat the lens, with the result that evaporation of the fluoride may be terminated by this control. The third patent covers a lens coated to different thicknesses in radial segments so that the total transmission for light of different colors is substantially uniform.

Sheet and Plate Glass

John L. Drake of Libbey-Owens-Ford Glass Co. has worked out a new method of supporting plate glass for surfacing which eliminates the preparation of plaster of paris bedding. This is related in patent 2,339,158 from which a plan of operation is reproduced in Fig. 3. The essence of the invention is the replacement of the plaster by a fusible metal alloy such as Wood's alloy which melts at about 160° F. In practice a glass sheet 11 is laid upon the top of the metal bed while the metal is cold. The glass sheet is then carried along to the grinding units 12, but before reaching them, passes beneath a heating means 17, mounted above the path

of travel of the sheet. These heaters preferably consist of a battery of infra-red electric lamps. The heating rays are transmitted through the glass sheets and cause the melting of the layer of metal. When this occurs the glass sheet floats upon the molten metal and its weight is enough to cause it to be bedded therein in such a manner as to cause the molten metal to conform to the under surface of the glass sheet. Upon leaving the lamps, the metal sets up hard and serves to hold the glass sheet firmly in place, so that it may then be ground and polished. Then the sheet is passed under a second battery of lamps 21, which again melts the alloy so that the sheet can be readily removed at the suction train, 15. After the glass is removed the metal hardens and is ready for another sheet.

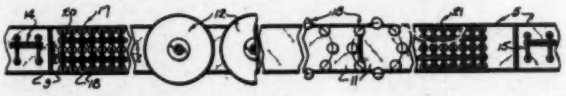

Fig. 3. 2,339,158: Drake. Plate glass is held on a table for grinding by embedding it on a bath of Wood's alloy which is afterwards melted to release the plate under a battery of infra-red lamps 21.

Economy is claimed for the process, since the metal, unlike plaster of paris, is reused with only minor losses, and because the use of labor is greatly decreased.

Glass Wool and Fiber

Fig. 4 illustrates the needling or sewing machine in which Games Slayter proposes to make a glass fiber mat which contains no extraneous backing, but is all fiber. He conveys a blanket of fibers 23 toward the

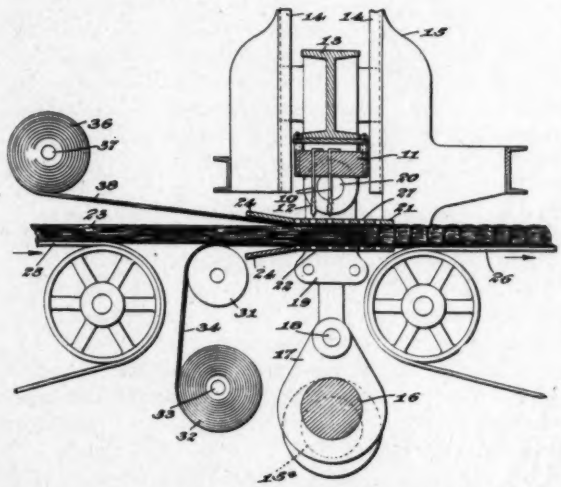

Fig. 4. 2,339,431: Slayter. Stitching machine for making a matting faced on both faces with webbing of long glass fibers.

machine and simultaneously faces it on both top and bottom with a continuous web of fibers of greater length, such as those produced by drawing rather than by air blast from jets. The composite article passes under a needling machine from which reciprocating needles 10 penetrate deeply into the blanket. The needles have barbed sides so that they catch the surface webbing and carry it into the mat to produce a stitching which consolidates the article. The needles may entirely penetrate the blanket. Mr. Slayter's patent is 2,339,431, assigned to Owens-Corning Fiberglas Co.

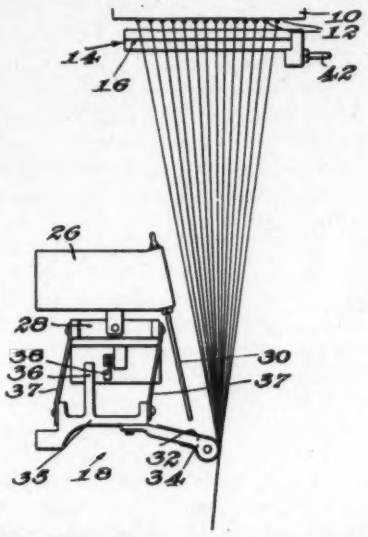

Fig. 5. 2,339,590: Thomas. In fiber drawing the stoppage of one or more fibers reduces tension at 34 so that a solenoid operated valve is opened to increase blast at 16 to prevent fouling of the entire drawing bushing.

Fig. 5 shows a plan suggested by J. H. Thomas and Nicholas Dragics in 2,339,590 (Owens-Corning) for overcoming one of the problems which daily plague the operator of a fiber drawing or attenuating machine. The figure illustrates a bushing 10, from the holes of which a number of fibers are being drawn together toward a wax applicator 34, and then to a winding drum which is not shown. Frequently one of the apertures will clog and the glass which readily wets the metal in the bushing will spread over it and foul the other holes. To clean off the entire bushing and get the attenuation started again is troublesome and consumes much time. This latest patent provides electrical energizing means so that the absence of even a single strand at the wax applicator reduces the tension on it and allows a switch to close so as to increase the blast pressure at the bushing. This increased air pressure will prevent the glass from spreading from the single clogged hole to the remainder of the bushing. In the drawing, 36 and 38 are the contacts which are brought together when the fiber tension diminishes to cause the operation of a solenoid controlled valve.

Another Owens-Corning patent of interest is 2,339,928 issued to Harrison P. Hood of Corning, N. Y. for a method of producing colored fibers for use in textiles. He has found that when the glass composition includes a reducible oxide such as that of lead or copper, colors in the range of brown, red and black may be produced

(*Continued on page* 130)

Research Digest

Practical Interpretations of Glass Technology

Instrumentation and Control of Glass Tanks

In the current issue (Vol. 1, No. 1) of "Instrumentation" (a new publication of the Brown Instrument Co.), there appears a comprehensive summary of a paper delivered before the American Ceramic Society by J. R. Green on the subject "Instrumentation and Control of Glass Tanks". This summary contains much that is of interest to those in charge of glass furnace operation and control.

The author develops the subject by describing ideas which are not in common use today in the glass industry, but which have become practical and of material value in other industries employing equipment of basically similar design. For example, in the case of furnace temperatures, a new method of measurement makes use of externally mounted radiation units sighted on closed end refractory tubes, which removes the measuring element proper from the high temperature zone, avoids deterioration of the rare metal element, and provides readings that change only as the wall thickness or relative position of the refractory target changes throughout its life. An alternate location for taking temperatures is through the side walls above the metal line, where two units operated in parallel from opposite sides of the tank serve to give a good representative reading of tank temperatures regardless of direction of firing. Installations of this type have met with considerable success in open hearth practice in the steel industry. The use of radiation units sighted on the glass surface in a tank results in a reading that approaches the flame or refractory wall temperature, owing to the high reflection of radiated energy from the glass surface.

In the stabilization and distribution of temperatures throughout the tank the factor of prime importance is furnace pressure because of its direct influence on the velocity of gases, shape of flame, locations of flame over the glass batch surface, luminosity of flame, refractory life, and, in some cases, volume of air admitted. Pressure control in glass tanks should be of the differential measurement type, that is, compensated for atmospheric pressure and temperature changes near the pressure tap. With any major change in tank temperature, the desired pressure usually should be changed to compensate both for the change in static pressure head in the tank caused by temperature and also for the desired change in flow of air and gases through the tank.

The use of an automatic control of the fuel flow has many advantages by delivering, regardless of the fluctuating piping and burner conditions, a constant and correct fuel flow. It stabilizes not only the temperature, but also the temperature distribution, flame character, checker balance, and combustion efficiency. Additional and valuable advantages can also be incorporated into the flow control system. By placing limit switches on the fuel and air revising valve, the control mechanism can be automatically reset so that with the opening of the fuel valve after reversal, the time and rate of fuel readmission to the furnace can be made exactly equal to the ability of the tank and checker system to deliver air to the on-coming burner ports for the desired combustion conditions. Thus, the control rate at which fuel is readmitted is equal to the actual air delivery to the firing ports and is followed by another rate of fuel increase to compensate for the decreasing air preheat temperature following the reversal. This latter change in rate helps to maintain a steady tank temperature.

Temperature measurements and control in the checker system should include: measurement of outgoing and incoming air temperatures in the flues between the checker and stack, stack temperatures (which will indicate the presence of a leaking reversal valve and the overall balance), measurement of the temperature conditions above the checkers (such measurements provide extremely valuable information as to conditions, namely, the maximum temperature being applied to the top courses of the checker brick during the heating cycle, and too, the nearest practical approach to preheated air temperature as delivered to the burners on the regenerative cycle), and the control of reversal periods. This latter may be based upon any one or a combination of conditions, including maximum, minimum and differential temperatures, and rate of checker temperature change. Reversal from a minimum temperature of preheated air, with an additional warning signal from high refractory temperatures on the outlet side, is also considered a good practical answer to this problem.

The maintenance of proper ratios between fuel and air also have a great bearing on the tank temperature, the type of flame and the temperature distribution in addition to the fundamental problem of combustion efficiency for lowest cost per ton of glass melted. Control of fuel-air ratio may be obtained by combustion control devices operating on a variety of principles. Since the flows involved remain quite constant, the individual measurement and control of both fuel and air is a very practical and economical system.

The author points out that the profitable and practical instrumentation of glass tanks is not limited to one application or any one instrument, but is secured by the stabilizing, and, in some cases, by the inter-connecting of a number of variables, by measurement and control of a number of different qualities. No single unit can do the entire job.

Glass Standards for Fluorometric Determinations

An article by E. Loewenstein in the October 1943, issue of "Industrial and Engineering Chemistry," Analytical Edition, is a very excellent illustration of how some of the little known properties of glass may be utilized in practice.

(*Continued on page* 129)

Above are illustrated some of the possibilities of a peacetime kitchen. Sparkling white enamel finds both artistic and utilitarian use in the sink, dishwasher and other units. Glass, more beautiful, durable and adaptable than ever, is seen in shelves and utensils—even as decorative trim on appliances.

These—and many more good things in the post war world—will be made with the aid of Kryolith. Kryolith, well-known flux and opacifier, is the *only* such natural Greenland ore sold in North America. Leading glass and enamel manufacturers prefer Kryolith for its ability to improve products and increase production.

Some of the important advantages of Kryolith are: the property of dissolving coloring oxides; its low melting point for faster reduction of the batch; its powerful, uniform and lasting fluxing action; and its excellent opacification.

Kryolith is supplied in 500 lb. barrels and 100 lb. bags. Write for further information.

KRYOLITH IN THE WAR . . . Kryolith is an important bonding material in resinoid grinding wheels used to finish alloy steels in tanks, warships and other equipment.

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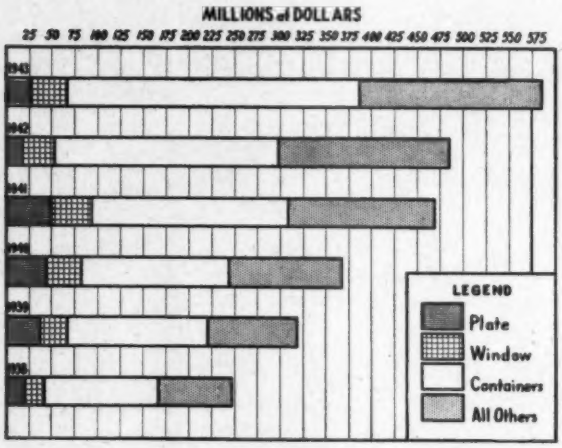
New York • Chicago • St. Louis • Pittsburgh • Minneapolis • Wyandotte • Tacoma

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX

Production: Twelve Months, January Through December



During December, 1943, activity in the glass industry stayed about on a level with that of the month of November. According to the Production Index, output during December was $47,000,000 as compared with $40,000,000 for the same month of 1942. The cumulative total for 1943 was $534,000,000 compared to $485,000,000 for the year 1942.

Plate glass production for the month of January, 1944, totalled 7,745,895 sq. ft., according to the report of the Plate Glass Manufacturers of America. This was a slight decrease from the amount reported in December, but an increase of 57 per cent over January, 1943.

GLASS CONTAINER PRODUCTION AND INVENTORY

(All Figures Are in Gross)

		Production Jan. 1943	*Stocks Jan.* 1944
Foods; Medical & Health Supplies; Chemical, Household, Industrials; Toiletries & Cosmetics	Narrow Neck	2,746,813	1,729,349
	Wide Mouth	3,030,189	1,149,686
Dairy Products		249,823	318,606
Home Canning		211,036	175,107
Beverages		504,365	307,732
Beers		647,748	137,240
Liquors		528,376	381,447
Wines		195,700	105,584
Packers Tumblers		89,280	14,569
Total		8,203,330	4,319,320

Glass container production during January totalled 8,203,330 gross, according to the Glass Container Association of America. This showed an increase of about 7 per cent over the preceding month, and of about 11 per cent over January, 1943.

Shipments of glass containers during January increased approximately 3 per cent over December and 10 per cent over January of 1943.

Inventories on glass containers for January were 4,319,320 gross—44 per cent less than the same month of 1943.

It has been customary in these reports to publish comparative data in percentages on shipments of glass containers by the various types and classes of ware. These figures indicated increases or decreases for the corresponding month of the preceding year. However, a change in the method of compilation of these statistics by the Glass Container Association will make unavailable for the balance of 1944 these particular comparisons.

Automatic tumbler production for January amounted to 5,298,454 dozens, an increase of 18 per cent over the total for January, 1943. Shipments of automatic tumblers during January were 5,135,840 dozens, as compared with 3,762,527 dozens shipped during the same month in 1943. Finished stocks on hand at the end of January were 6,233,135 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware were reported at 1,524,771 for January, a decrease of 58 per cent from January, 1943.

GLASS CONTAINER SHIPMENTS

(All Figures Are in Gross)

Narrow Neck Containers	*January* 1944
Foods	602,719
Medicinal & Health Supplies	1,159,183
Chemical, Household, Industrials	570,528
Beverages	449,017
Beers	615,821
Liquors	418,073
Wines	194,086
Toiletries & Cosmetics	448,156
Sub-Total (Narrow Neck)	4,457,583

Wide Mouth Containers	
Foods	2,372,969
Dairy Products	242,419
Home Canning	190,120
Medicinal & Health Supplies	285,901
Chemical, Household, Industrials	226,185
Toiletries & Cosmetics	160,676
Packers Tumblers	95,885
Sub-Total (Wide Mouth)	3,574,155
Total Shipments	8,031,738

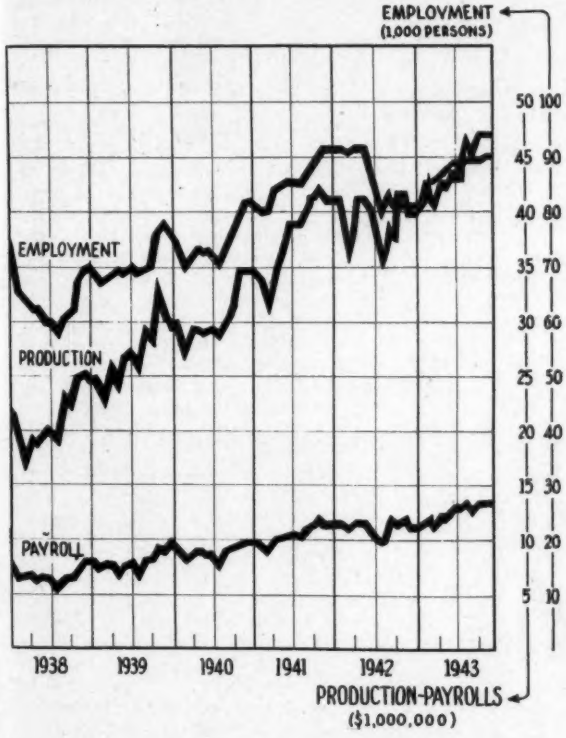
Miscellaneous glass products manufactured in December, 1943, were estimated at $18,000,000, the same as that reported for November. The total miscellaneous glass products for 1943 amounted to $199,000,000, comparing with $188,000,000 for 1942.

Employment and payrolls: The number of persons employed in the glass industry during December totalled 91,000, the same number as reported for November. This compares with 81,000 employed during the same month in 1942.

Payrolls in December were estimated at $13,500,000, which is the same as shown for November. This is an increase of 17 per cent over December, 1942. Glass manufacturers paid out about $167,000,000 in salaries for the year 1943.

GI THE GLASS INDUSTRY'S INDEX

Monthly Trends Through December, 1943

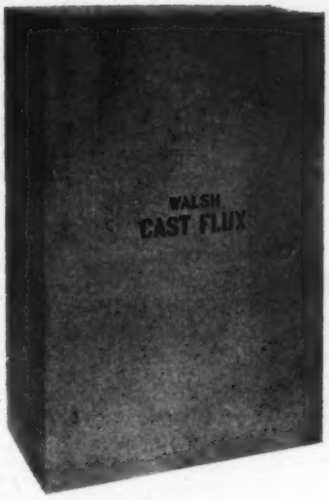


Contribute to the

RED CROSS

Buy More War Bonds

WALSH CAST-FLUX



The Vacuum-cast flux block of superior quality.

Walsh Cast-Flux blocks are machine-trued to exact size and shape after burning.

THEY LAST LONGER

The excellent results obtained in numerous tanks melting various types of glass has definitely established the efficiency and economy of Walsh Cast-Flux blocks.

Walsh Cast-Flux has a dense, uniform structure; it is burned at higher temperatures, is thoroughly bonded and possesses a low coefficient of expansion.

Walsh Cast-Flux blocks meet the most rigid requirements for tanks operating at higher temperatures . . . they insure greater tonnage, higher quality glass, freedom from defects, longer life and maximum economy.

WALSH REFRACTORIES CORPORATION

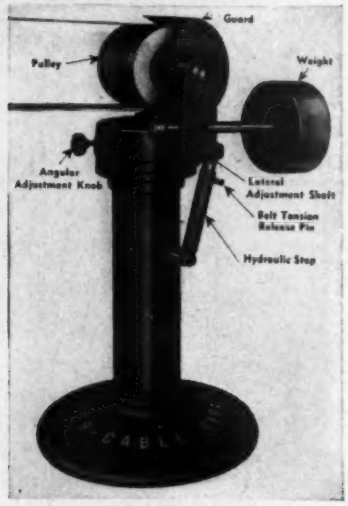
Manufacturers of Refractories for the glass industry for over 50 years

4428 North First Street

St. Louis Missouri

NEW EQUIPMENT AND SUPPLIES

NEW PORTER-CABLE BACKSTAND IDLER



The Porter-Cable Machine Company of Syracuse, New York, recently announced a new addition to their line of Abrasive Belt Grinders—The Backstand Idler Model ABS.

This Idler is used to adapt grinding and polishing lathes to abrasive belt grinding. Heretofore, it has been necessary to coat the grinding and polishing wheels with the abrasive or use a solid "stone" wheel.

Where it has been customary to grind, rough polish and finish on regular wheels, the same results are obtained by the abrasive belt method, but the rough polishing operation can be eliminated. All of these factors have a tendency to lower grinding and polishing costs.

Any width felt up to 6″ can be used.

PORTABLE HEATING TANKS

One of the many kinds of special heating tanks now being built by the Youngstown Miller Company, Sandusky, Ohio, is their Model 20. This is portable and consists of a well insulated heating tank equipped with electric heaters—a motor and pump for circulating the oil—thermostats for maintaining the oil temperature within certain limits—complete with electric controls, valves all mounted on casters.

VISUALIZER TO AID IN UTILIZATION OF ADVERTISING SPACE

The Meyercord Co., Chicago, manufacturers of Decal truck lettering and pictorials, are distributing an informative layout and copy visualizer to aid truck owners in the maximum utilization of the free advertising space on their motor fleets.

The Visualizer includes selected illustrations of decorated truck bodies and skeleton diagrams of body types for experimental lettering and designing by truck owners.

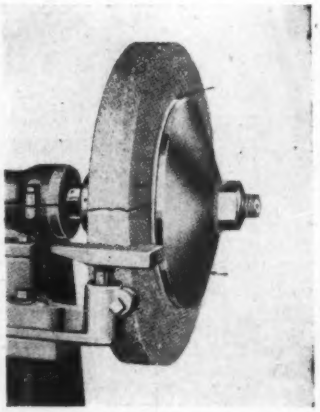
SAFETY WASHERS FOR GRINDING WHEELS

The Industrial Products Company of Philadelphia recently announced the production of safety washers for grinding wheels. These are designed to prevent accidents due to broken segments of a grinding wheel leaving the shaft.

They consist of 20-gauge steel discs to which have been vulcanized a surface of specially compounded rubber, one washer being applied to each side of the grinding wheel with the rubber adjacent thereto. When pressure of the outside steel flanges is applied, the rubber is forced into the porous surface of the wheel holding it firmly in place.

The illustration shows a 14″ diameter wheel, which after being broken in two pieces had a continuous run for five hours at 2250 RPM. The wheel held intact.

These washers are available for wheels having flanges up to 30″ diameter.



GOGGLE CLEANING CABINET

The Mine Safety Appliance Company of Pittsburgh has recently developed the Goggle Cleaning Cabinet to encourage workmen to wear their goggles and keep them clean. The compact cabinet is equipped with an efficient lens cleaning and anti-fogging solution and optical wiping tissues. The unit is ideal for mounting in strategic work locations and in repair rooms, tool rooms, locker rooms or on traveling dispensing carts.

CATALOGUES RECEIVED

General Electric Company, Schenectady, N. Y., recently issued a 12-page bulletin (GEA-4126) on the fundamentals and various applications of electronic control. The publication explains in clear, simplified language the fundamental principles of electronic tubes and their operation. Also listed are the various advantages afforded by the use of electronic control.

Towmotor Corporation, Cleveland, Ohio. "Lift Truck Operators Guide," a booklet published by Towmotor Corporation, is an aid to both new and experienced lift truck operators. This pamphlet interprets to industrial truck operators the importance of the materials handling function and emphasizes the increasing variety of tasks that are being given lift trucks in present day handling systems.

Leeds & Northrup Company, Philadelphia, Pa.—A new catalog issued by Leeds & Northrup Company will be of interest for operators of industrial processes, such as neutralization, precipitation, corrosion-prevention and boiler feedwater treatment, when it is necessary for them to be able to "see" pH at a glance, or to refer to a continuous pH record drawn on a handy chart.

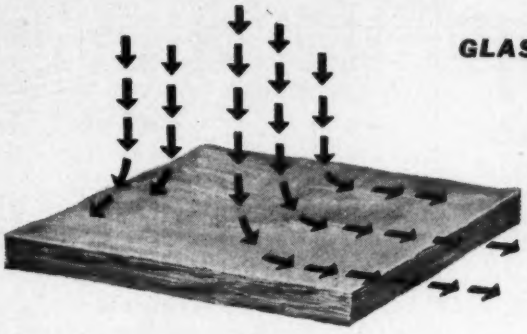
This catalog describes an equipment which consists of just two elements: an unusually rugged glass-electrode assembly and a Micromax Recorder—either a strip-chart Model S or a round-chart Model R. Where operators should have an unusually bold guide to pH, the Model R is used. For a more detailed record of pH, over a longer period of time, the Model S is used.

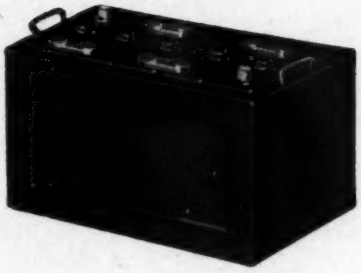
The Chemical Publishing Co., Inc., Brooklyn, N. Y. This concern has just issued a new catalog of technical books. It includes the latest books on chemistry, technology, physics, general science, mathematics, engineering, radio, aviation, foods, metals, etc. The catalog gives the date of publication of each book and a concise description and table of contents.

CATALOGUE & BULLETIN SERVICE

Current catalogs and manufacturers' service bulletins received in this department may be obtained by writing to THE GLASS INDUSTRY.

LOOK TO THE FUTURE *Thru Glass!*





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for winter storage batteries

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TABLE 3. COMPARISON OF IMMERSION DETERMINATIONS OF INDEX OF REFRACTION AND DISPERSION WITH SPECTROMETER VALUES

Sample No.	n_D	*Error* x 10^{-5}	n_F	*Error* x 10^{-5}	n_C	*Error* x 10^{-5}	ν	*Error*
I.								
Spectrometer	1.51651		1.52211		1.51411		64.6	
Immersion 1	1.51653	+2	1.52213	+2	1.51412	+1	64.6	0
2	1.51653	+2	1.52209	−2	1.51413	+2	64.9	+.3
3	1.51650	−1	1.52210	−1	1.51410	−1	64.6	0
4	1.51651	0	1.52208	−3	1.51412	+1	64.9	+.3
Average	1.51652	1	1.52210	2	1.51412	1	64.8	.2
II.								
Spectrometer	1.51748		1.52316		1.51507		64.0	
Immersion 1	1.51746	−2	1.52318	+2	1.51509	+2	64.0	0
2	1.51747	−1	1.52316	0	1.51510	+3	64.2	+.2
3	1.51750	+2	1.52317	+1	1.51508	+1	64.0	0
4	1.51746	−2	1.52313	−3	1.51508	+1	64.3	+.3
Average	1.51747	2	1.52316	2	1.51509	2	64.1	.1
III.								
Spectrometer	1.57205		1.57906		1.56913		57.6	
Immersion 1	1.57202	−3	1.57909	+3	1.56914	+1	57.5	−.1
2	1.57202	−3	1.57904	−2	1.56909	−4	57.5	−.1
3	1.57206	+1	1.57905	−1	1.56911	−2	57.6	0
4	1.57206	+1	1.57906	0	1.56911	−2	57.5	−.1
Average	1.57204	2	1.57906	2	1.56911	2	57.5	.1
IV.								
Spectrometer	1.57151		1.57850		1.56859		57.7	
Immersion 1	1.57150	−1	1.57849	−1	1.56858	−1	57.7	0
2	1.57151	0	1.57853	+3	1.56860	+1	57.6	−.1
3	1.57154	+3	1.57847	−3	1.56861	+2	58.0	+.3
4	1.57151	0	1.57846	−4	1.56858	−1	57.8	+.1
Average	1.57152	1	1.57849	3	1.56859	1	57.8	.1
V.								
Spectrometer	1.60428		1.61419		1.60027		43.4	
Immersion 1	1.60431	+3	1.61416	−3	1.60025	−2	43.4	0
2	1.60430	+2	1.61416	−3	1.60024	−3	43.4	0
3	1.60431	+3	1.61420	+1	1.60023	−4	43.3	−.1
4	1.60428	0	1.61419	0	1.60028	+1	43.4	0
Average	1.60430	2	1.61418	2	1.60025	3	43.4	0
VI.								
Spectrometer	1.60454		1.61446		1.60053		43.4	
Immersion 1	1.60454	0	1.61450	+4	1.60056	+3	43.4	0
2	1.60457	+3	1.61449	+3	1.60054	+1	43.3	−.1
3	1.60456	+2	1.61450	+4	1.60053	0	43.3	−.1
4	1.60454	0	1.61447	+1	1.60057	+4	43.5	+.1
Average	1.60455	1	1.61449	3	1.60055	2	43.4	.1
VII.								
Spectrometer	1.61804		1.63018		1.61320		36.4	
Immersion 1	1.61804	0	1.63020	+2	1.61322	+2	36.4	0
2	1.61803	−1	1.63019	+1	1.61323	+3	36.4	0
3	1.61801	−3	1.63019	+1	1.61324	+4	36.5	+.1
4	1.61806	+2	1.63017	−1	1.61325	+5	36.5	+.1
Average	1.61804	2	1.63019	1	1.61324	3	36.5	.1
VIII.								
Spectrometer	1.61731		1.62942		1.61249		36.5	
Immersion 1	1.61734	+3	1.62941	−1	1.61250	+1	36.5	0
2	1.61729	−2	1.62943	+1	1.61252	+3	36.5	0
3	1.61728	−3	1.62937	−5	1.61252	+3	36.6	+.1
4	1.61729	−2	1.62940	−2	1.61252	+3	36.6	+.1
Average	1.61730	3	1.62940	2	1.61252	3	36.6	.1
IX.								
Spectrometer	1.62024		1.63248		1.61536		36.2	
Immersion 1	1.62023	−1	1.63249	+1	1.61536	0	36.2	0
2	1.62024	0	1.63251	+3	1.61536	0	36.2	0
3	1.62027	+3	1.63252	+4	1.61540	+4	36.2	0
4	1.62027	+3	1.63246	−2	1.61539	+3	36.3	+.1
Average	1.62025	2	1.63250	3	1.61538	2	36.2	0
X.								
Spectrometer	1.62023		1.63247		1.61536		36.2	
Immersion 1	1.62022	−1	1.63246	−1	1.61539	+3	36.3	+.1
2	1.62024	+1	1.63247	0	1.61535	−1	36.2	0
3	1.62025	+2	1.63242	−5	1.61537	+1	36.4	+.2
4	1.62025	+2	1.63248	+1	1.61536	0	36.2	0
Average	1.62024	2	1.63246	2	1.61537	2	36.3	+.1
XI.								
Spectrometer	1.64918		1.66296		1.64373		33.8	
Immersion 1	1.64918	0	1.66300	+4	1.64375	+2	33.7	−.1
2	1.64917	−1	1.66296	0	1.64370	−3	33.7	−.1
3	1.64915	−3	1.66296	0	1.64371	−2	33.7	−.1
4	1.64917	−1	1.66293	−3	1.64373	0	33.8	0
Average	1.64917	1	1.66296	2	1.64372	2	33.7	.1
XII.								
Spectrometer	1.64845		1.66220		1.64301		33.8	
Immersion 1	1.64845	0	1.66215	−5	1.64301	0	33.9	+.1
2	1.64847	+2	1.66217	−3	1.64299	−2	33.8	0
3	1.64842	−3	1.66218	−2	1.64296	−5	33.7	−.1
4	1.64845	0	1.66218	−2	1.64306	+5	33.9	+.1
Average	1.64845	1	1.66217	3	1.64300	3	33.8	.1

A PRECISION APPARATUS . . .

(*Continued from page* 112)

ard on the refractometer both before and after each group of four immersion measurements, a comparison method was used that approximates a substitution method. Other factors which should be mentioned are:

1. Temperature differences between the refractometer and immersion tank were rarely greater than 0.1° and the temperature effects were considered in obtaining the final values.

2. The recommended tests to eliminate shielding of rays, setting on false edges, etc.,[10] were frequently made.

Although the errors introduced in matching are, in general, negligible, the experience of the operator plays a part in these determinations. This is due to surface effects that interfere with the determination of a match. The ideal condition is one which produces a uniformly illuminated field against which the sample is invisible. This exists very rarely in actual practice. Usually, under conditions of match, the main body of the sample will blend with the field, but the edges of the sample will be outlined by very thin brilliant lines. In these cases, a match is determined by rotating the sample through 180°. There should be no change in the thickness or brilliance of these lines when this is done. Thus any confusion due to surface effects may be avoided. The experience of the operator will also determine the speed with which measurements are made. An experienced person can measure about six samples in an eight-hour day. Thus it is possible to secure complete information on the index of refraction and ν value for a particular melt within one and one-half hours after a pot of glass is opened.

Summary

An improved apparatus for determining indices of refraction and dispersion of glass by immersion is described. The results of 144 measurements indicate that the index of refraction may be determined with an average error of $\pm 1.9 \times 10^{-5}$ and a maximum error of $\pm 5 \times 10^{-5}$. Dispersion as represented by ν values may be calculated from these measurements with an average error of 0.1 and a maximum error of 0.8. This apparatus may, therefore, be used both for routine production control work and for the determination of the optical constants of finished optical components, especially of flint glasses. It may also be applied profitably to research in the determination of the effect of composition on the optical properties of glass, especially where the glasses studied may be unstable. The full possibilities of the matching instrument have not been determined. More accurate refractometers and temperature controls are necessary for this purpose.

[1] H. L. Gurewitz and L. M. Tilton, J. Research NBS 32, 39 (1944); RP 1572.

[2] C. A. Faick and A. N. Finn, J. Research NBS 6, 993-1002 (1931); RP 320.

[3] For a discussion of immersion refractometry, see Glazebrook's Dictionary of Applied Physics, 4, 130 (The Macmillan Co., New York, N. Y., 1923).

[4] C. P. Saylor, J. Research NBS 15, 277-294 (1935); RP 829.

[5] R. W. Cheshire, Phil. Mag. (6) 30, 409-420 (1916).

[6] By use of a monochromator, it was possible to avoid difficulties arising from other lines in the sodium source and from the continuous spectrum in the hydrogen tube. Filters like those used on the refractometer were found unsatisfactory on the matching instrument.

[7] Mercury-in-glass type graduated to a tenth of a degree, permitting the estimation of hundredths of a degree. The thermometers should be carefully checked against each other since the difference in temperature is the important factor.

[8] L. W. Tilton, J. Opt. Soc. of Am. 32, 371-381 (1942).

[9] L. W. Tilton, J. Research NBS 30, 311-328 (1943); RP 1535.

[10] See footnote 9.

STAFF MEMBERS NAMED FOR NEWLY CREATED CHEMICAL DIVISION OF THE B. F. GOODRICH COMPANY

The B. F. Goodrich Company has announced the staff appointments for its recently created chemical division. Mr. William I. Burt is general manager of plants; Dr. Frank K. Schoenfeld, technical and development director; Dr. Victor E. Wellman, director of purchases, and Harry E. Foster, general auditor.

Mr. Burt will be responsible for operation of all plants in the chemical division; Dr. Schoenfeld of technical matters, sales service and process development; Dr. Wellman of all purchasing and raw material inventory control, and Mr. Foster for all plant and sales accounting.

Another recent appointment by The B. F. Goodrich Company is that of H. W. Catt, who has been named manager of the chemicals and pigments department of the purchasing division. He fills the vacancy left by the appointment of Dr. Wellman to a new position.

G. T. ROBINSON NEW CINCINNATI MANAGER FOR WYANDOTTE CHEMICALS CORPORATION

Mr. G. T. Robinson was appointed manager of the Cincinnati office of the Wyandotte Chemicals Corporation (Michigan Alkali Division) on January 1, 1944.

Mr. Robinson joined the company in 1927, and for several years has been Central Regional Supervisor for the J. B. Ford Division, with headquarters in Cleveland.

OWENS-ILLINOIS OFFICIAL HONORED BY AMERICAN LEGION

Randolph H. Barnard, executive vice-president of Owens-Illinois Glass Company, has been appointed to serve on the Labor, Management, Private Enterprise and Public Activities Committee of the American Legion's Commission on Post War America.

The Legion is endeavoring through this, and other subcommittees, to develop, with the Army, Navy, Maritime Commission and the State Department, a program on Post War America.

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GLASS SCIENCE, INC. . . .

(*Continued from page* 115)

sons only and interested in the purposes of the corporation and may include scientists, educators, and persons associated with the Bureau of Standards, the War Department, the Navy Department, or any other Federal or State agency, bureau, or department whose activities are concerned with any of the activities carried on by the corporation.

"*Election or Appointment to Membership.* All sustaining, subscribing, and associate members shall be elected by the members or by the board of directors.

"Representative members shall be appointed by the sustaining or subscribing member with which they are connected, as aforesaid. There shall be only one representative member for each sustaining and subscribing member.

"In electing sustaining and subscribing members, it shall be the policy of the corporation to elect all applicants having a legitimate interest in the purposes of the corporation."

With regards to dues and assessments it is stated that Representative and Associate members will not be liable for the payment of either of these monetary obligations. Subscribing and sustaining members will not enjoy voting rights at member meetings. Also, Associate members are denied voting franchise. It is stated, however, that each representative member shall be entitled to one vote at every meeting of members.

In providing for the appointment of various committees by the board of directors from time to time for carrying on the business affairs and functions of the institute, the by-laws do not restrict the appointment to these committees to directors or members only, with the exception of individuals appointed to the executive committee.

THREE-DIMENSIONAL PICTURES HELP FIGHT THE JAPS

Commander Robert S. Quackenbush, Jr., recently in charge of a photographic unit in the South Pacific area, announces that a three-dimensional picture of a cocoanut tree near a hill sheltering a Jap gun emplacement on Munda helped Navy gunners to blast the emplacement. Knowing the height of the cocoanut tree they were able to gauge the height of the hill by seeing that it appeared to be just twice as tall as the tree in the three-dimensional picture.

Commander Quackenbush disclosed the fact that the three-dimensional pictures, known as Polaroid vectographs, have been used for over a year in the battle against the Japs. Although a vectograph is as thin as a piece of paper, it appears to have all the depth of the actual scene when it is viewed through light-polarizing spectacles.

Developed by Polaroid Corporation, the vectograph process is the first practical and rapid system of making faithful three-dimensional pictures which can be viewed simultaneously by any number of people wearing the special polarizing spectacles.

RESEARCH DIGEST . . .

(*Continued from page* 120)

The analyses of certain vitamin preparations are made by a method known as fluorometric analysis using instruments known as fluorophotometers. These depend on the evaluation of the brightness of the light emitted as a result of fluorescence and require a standard having the proper color and intensity of fluorescence. In the past, these standards have been prepared from organic chemicals. As such liquid standards are tedious to prepare, and are unsatisfactory in other ways, a search was made for a material which would be more satisfactory.

Many glasses exhibit strong fluorescence which is characteristic of the particular sample, but all melts of a given type of glass will not fluoresce in the same manner. The strength of fluorescence is primarily dependent upon the chemical composition and the previous history of the particular glass melt of which it is a part. Trace elements, time and temperature of melting, annealing, cooling, etc., all affect the fluorescence which any glass may show. A large group of glass was studied and certain glasses were selected as being suitable for fluorometric standards.

While the amount of glass used for this purpose is small it is serving a critical need and does illustrate how various uncommon properties of glass may be utilized.

Refractivity of Optical Glass

The manufacture of optical glass in large quantities for precision uses necessitates many measurements of refractive index that cannot be made with needed accuracy on refractometers. The time required for the precise computation of indices after measurements of minimum deviation on prisms of various angles near 60° is materially shortened, and the chances of error are reduced, by using special tables and a slide rule instead of logarithms or a computing machine. Helen L. Gurewitz and Leroy W. Tilton have prepared one such table merely doubling the values read from a table of natural sines at intervals of 15 seconds of arc. This is really a table of refractive indices for a prism of exactly 60° listed as a function of (double) deviation. A second table of auxiliary coefficients has been prepared for changing the actually observed (double) deviation for any prism of 60° ±30′ to the corresponding (double) deviation for a prism of exactly 60°. This permits the first table to be used for all prisms in the range 60° ±30′. Copies of these tables and a discussion of methods for determining refractive index and dispersion of optical glass so as to control its quality was published as RP1572 in the January number of the Journal of Research.

● Execution of a contract with the Pittsburgh Plate Glass Company to provide manufacturing facilities at a plant in New Martinsville, West Virginia, at a cost of $420,000 has been authorized by the Defense Plant Corporation, subsidiary of RFC, according to an announcement by Secretary of Commerce Jesse Jones.

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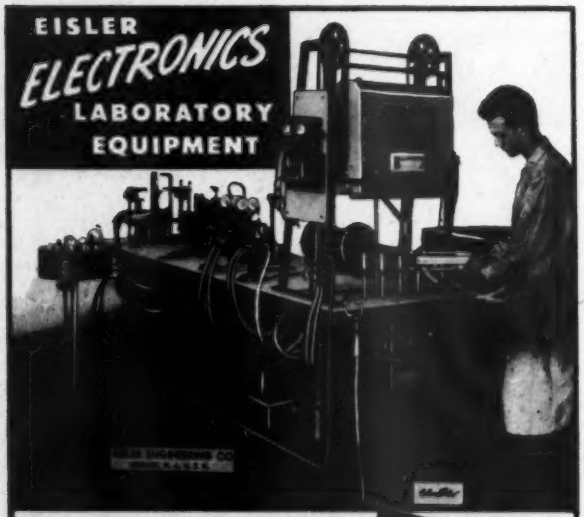

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INVENTIONS AND INVENTORS . . .

(*Continued from page* 119)

by subjecting the fibers to a reducing atmosphere. A treatment for an hour at about 325 to 425 degrees C. is satisfactory for most glasses. The high rate of travel of fibers as they issue from the forming jets obviously will prevent the application of the process to the fibers while they are being formed. Hood reports that simple soda-lime glasses do not lend themselves to coloration by copper, but good effects are obtained when boric oxide or alkali fluoride, arsenic or antimony are used. The patent devotes considerable discussion to further comments on the composition requirements.

Other fiber patents issued during January are 2,338,839 to H. T. Coss of Johns-Manville Corp. for a method of making mineral wool felt with thermo-setting and thermo-plastic resin binders, and 2,338,473 to G. von Pazsicky of Hamburg, Germany, for a method and apparatus for producing fibers by a combination of blowing and centrifugal forces. The latter patent, now vested in the Alien Property Custodian, was discussed and illustrated as application APC 303,058 on page 346 of the August 1943 GLASS INDUSTRY.

HOLOPHANE EXECUTIVE ELECTED PRESIDENT OF OHIO ENGINEERS

Mr. T. W. Rolph, vice president of the Holophane Company, was recently elected president of the Ohio Society of Professional Engineers.

Mr. Rolph is a member of the Illuminating Engineering Society, an associate member of the Optical Society of America, and president of the Newark, Ohio, Rotary Club.

OPA TO CONSIDER PRICE INCREASES FOR CERTAIN GLASS CONTAINERS

Under an amendment to MPR 188, effective February 22, OPA will consider applications for price increases on certain types of narrow-mouth glass containers, where such increases appear necessary to maintain essential wartime production.

In no case may the increase in container prices serve as the basis for an increase on the packed item, the order stipulates.

"Eligible manufacturers who plan to file for price adjustments should obtain from the OPA Containers Division a statement of specific information they will need to report."

Applications may be filed only on containers used for items or commodities declared "essential" by the WFA or some other government procurement or supply agency. Each application for a price adjustment also must establish to the satisfaction of OPA that prevailing production costs are higher than current MPR ceilings for the particular glass container involved.

GLASS IN THE WAR AND B_2O_3

In this war of materials, glass is playing a tremendously important part. Many kinds of glass are directly or indirectly aiding the over-all effort. From the lowly bottle or jar to the finest precision bomb-sight lens, glass is filling requirements that no other product can meet. Not all glass contains Borax or Boric Acid but in some glasses these products are absolutely essential, depending upon the specific use for which the glass is intended. Twenty-Mule-Team Borax and Boric Acid is directly contributing to the war effort where these materials are essential batch ingredients. Those manufacturers who are not now using Borax will find definite advantages in quality of product and manufacturing operations by inclusion of Borax in the batch formula.

PACIFIC COAST BORAX COMPANY

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A. C. S. MEETING . . .

(*Continued from page* 114)

Fume or Vapors from Molten Glass. *By C. A. Bradley, Jr., Corning Glass Works, Corning, N. Y.*

Discussion Round Table. *By A. W. Dodge, Hazel-Atlas Glass Co., Zanesville, Ohio; W. W. Oakley, Corning Glass Works, Corning, N. Y., and J. W. Wright, Owens-Illinois Glass Co., Alton, Ill.*

Qualitative Spot Tests for Minor Constituents in Glass. *By S. Zerfoss and R. L. Hess, Pennsylvania State College, State College, Pa.*

Energy Additivity in Glasses. *By Maurice L. Huggins and Kuan-Han Sun, Eastman Kodak Co., Rochester, N. Y.*

Effect of Substituting MgO for CaO on Certain Physical and Chemical Properties of Typical Soda-Lime Glasses. *By General Research Laboratory, Owens-Illinois Glass Co., Toledo, Ohio.*

Nickel-Bearing Diopsides. *By M. A. Knight and F. W. Preston, Preston Laboratories, Butler, Pa.*

Homogeneity of Glass. *By F. V. Tooley, Owens-Corning Fiberglas Corp., Newark, Ohio.*

The Lewis Acid-Base Theory Applied to Glass. *By Kuan-Han Sun and Alexander Silverman, University of Pittsburgh, Pittsburgh, Pa.*

American Society for Testing Materials. *By Committee C-14 on Glass and Glass Products, J. C. Hostetter, Chairman.*

The Glass Division Luncheon and Business Meeting is scheduled for Wednesday noon and an interesting feature of the luncheon will be a talk, "Eighteenth Century English and Irish Glass," by Douglas C. Carson, Director of Antique Department, Steuben Glass, Inc.

Complete details are lacking with regard to the entertainment phase of the meeting. However, an informal Victory Dinner and Entertainment is planned for Monday evening starting at 7:30 P.M. The Camera Club will hold its annual dinner Tuesday evening from 7:00 to 9:00 P.M. followed by the usual A.C.S. Meeting dance and entertainment.

DWIGHT R. MEANS GETS NEW APPOINTMENT AT PITTSBURGH PLATE GLASS

Announcement has been received of the appointment of Dwight R. Means as Assistant to E. T. Asplundh, vice president of the Pittsburgh Plate Glass Company in charge of the Columbia Chemical Division.

Mr. Means joined the staff of the Columbia Chemical Division twenty-one years ago as a draftsman. Prior to his new appointment he was technical director and had previously served as research director and assistant superintendent.

RANGEFINDER TAKES SHOCK TEST

Mounted in a "shock cradle" which reproduces the recoil of a battleship's 16-inch rifles, this big rangefinder is undergoing inspection at the Bausch & Lomb Optical Company, following tests to shake the alignment of its parts.

The 1600 optical and mechanical parts contained in the tube are as accurate as science and skill can make them, performing instantaneous feats of trigonometry when the target is sighted and transferring this data to the plotting room where it is spun into a formula with other variables before the guns are fired.

OPTICAL SANDWICH AID TO GUNNERS

The Polaroid Corporation announces that a crucial filter production bottleneck has been broken by a five-layer sandwich technique perfected by its engineers.

This technique, a simple process performed by a complicated machine, is the only method for producing in large quantities the important filters which enable bombardiers and fire control officers to see and hit enemy targets which are often hard to see with the naked eye because of horizon haze and sunglare.

A NOVEL USE OF GLASS BY THE ARMY

America's new modern Army uses glass in various ways. A novel method of emphasizing that soldiers should never talk about troop movements or anything else that might endanger their lives or those of other members of the military forces is a mirror located in the Officer and Civilian Personnel section of the huge Quartermaster Replacement Training Center, at Camp Lee, Va.

TECO ENGINEERED

MEANS especially STREAMLINED for uncommon EFFICIENCY

A consistent record of high efficiency in TECO designed glass plants is due primarily to TECO Luminous Flame Firing.

This Patented system of firing produces glass of high quality—gives increased output—and results in lowered fuel costs and reduced maintenance.

Exclusive design gives these results through *control* of fuel gas and air to produce a flame of high luminosity and *control* of that flame as to length, shape and position above the melt.

Contributing also to the overall efficiency of TECO designed plants are well coordinated related units, proved in years of experience, which produces completely streamlined layouts of uncommon efficiency.

Consult TECO engineers, whether interested in the designing of a complete plant, modernizing of your present tank and equipment—or, aid in solving any production problem with which you may be confronted.

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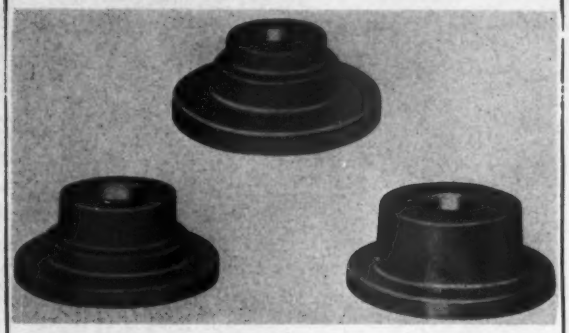
Gunite's Standard grade A
for
Guide Rings



Like all Gunite glasshouse castings Standard grade A is used for guide rings because it is best adapted to this particular purpose.

There is a suitable Gunite Alloy for every type of glass mould part requirement. Miller plungers and guide rings, neck ring sticks, brushing stock, press and blow moulds.

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LACLEDE-CHRISTY CLAY PRODUCTS COMPANY BEGINS SECOND CENTURY OF SERVICE

The Laclede-Christy Clay Products Company began in 1844 when a St. Louis firebrick manufacturing company was founded. In 1856, James Green, contractor and furnace builder, purchased a half interest in this company to insure a constant supply of firebrick for his needs. He became the sole owner in 1863, and the business was incorporated under the laws of the State of Missouri as the Laclede Fire Brick Manufacturing Company in 1869.

In 1907, the Laclede Fire Brick Manufacturing Company and the Christy Fire Clay Company, the latter engaged primarily in the manufacture of refractories for the glass industry, were consolidated and incorporated under the laws of the State of Missouri as the Laclede-Christy Clay Products Company.

With the acquisition in 1931, of the entire assets of the Buckeye Clay Pot Company of Toledo, Ohio, Laclede-Christy became the world's largest producer of glasshouse refractories for the glass industry.

Wide diversification is evidenced by the fact that the Company has developed six lines of products: general refractories, glass refractories, super-refractories, suspended flat arches and support walls, vitrified products, and high-temperature refractory specialties.

The present officers of the Company are William P. Hemphill, president; A. H. Killinger, vice-president; W. J. Godejohn, vice-president; L. C. Hewitt, vice-president; R. T. Risk, secretary and treasurer; and J. H. Schoemaker, assistant secretary and assistant treasurer.

GAS CITY, INDIANA, COMMENDED FOR ITS WAR EFFORT

Gas City, Indiana, is a community with a population of less than 4,000 people, but when the call went out for volunteers in the local war plant, the Owens-Illinois Glass Company, more than 1,150 people went to work there. This plant makes glass containers for medicines and pharmaceutical products and much of its production goes into direct war duty.

Some of those either working full time or part time in the glass plant are the local school principal, a theater manager, two clergymen, a coal merchant and all of the high school seniors.

In commending Gas City for its ready response to emergency, Paul V. McNutt, chairman of the War Manpower Commission, urged people all over the country to volunteer for part time work in war plants in their home communities.

WICKWIRE SPENCER STEEL APPOINTS NEW SALES RESEARCH ENGINEER

Word has been received of the appointment of Mr. H. C. Allington as Sales Research Engineer for Wickwire Spencer Steel Company. He will be in charge of the development and expansion of markets for the company's products with particular emphasis in the oil and petroleum fields.

Prior to joining Wickwire Spencer, Mr. Allington was district manager of the Logan-Allington Company, Inc.

NEW TEST FOR GROUND GLASS SURFACES

Bausch & Lomb Optical Company has recently adopted a new and simple method of testing the accuracy of ground optical surfaces by means of optical test glasses. This method employs wax to fill up the furrows created by emery in the grinding process, and so give the glass a smooth, reflecting surface.

The test glass, employed with monochromatic light, is the most accurate method known for discovering the nature and amount of surface irregularities. Utilizing light waves, which are fundamental and unalterable units of measurement, test glasses disclose, by the phenomena of interference, a series of bands or rings created by light reflected from the surface of the measured object and the test glass. The arrangement of these bands in parallel patterns or concentric rings shows the nature and amount of irregularity in fractions of a millionth of an inch.

CONTAINER PRODUCTION CAPACITY ESTIMATED AT OVER 98,000,000 GROSS FOR 1944

In its annual survey of manufacturing capacity the glass container industry has rated its potential capacity for 1944 at 98,275,184 gross. Provided this volume is achieved it will represent an increase of approximately six per cent over actual production in 1943 which in itself broke all previous records with a total of 92,706,953 gross.

Three factors seem to be responsible for the projected rated capacity of the industry—1. An increase in total melting area—2. Leap year adding one extra day to 1944's total production—and, probably of greatest importance—3. A substantial reduction in average weight of glass per gross of containers. It should be noted that although considerably increased grossage has been obtained through reduced glass weight, packaging capacity per unit has remained unimpaired.

ELECTION OF OFFICERS AT CORNING GLASS WORKS

Corning Glass Works has announced the re-election of Amory Houghton as chairman of the board while he is serving as deputy chief administrator of the United States Economic Mission for Foreign Affairs in London.

Glen W. Cole, president, also was re-elected at a meeting of the board of directors at the main offices in Corning.

At the same time elections of officers of two subsidiaries, Steuben Glass, Inc., and Corning Realty Corporation, took place. Robert J. Leavy was continued in office as president of Steuben, and William H. Curtiss was re-elected president of the realty corporation. In each case the board meeting was conducted immediately after the annual meeting of stockholders.

Mr. Houghton has been serving with the government economic mission since last fall. When he left for England in November he expressed belief that his assignment would be completed in a year, and said that he hoped to be able to return to this country for a short time every few months.

GLASS INSPECTION
with the *Polaroid*

Spectacle type polariscope

THE polarizing spectacle, mounted in unit with sensitive tint plate of 565 millimicrons, presents an absolutely uniform field of large aperture, strains showing up in sharply defined and correct colors.

Standard size apertures are 6" diameter and 12" diameter, and a rectangular size of 8" x 16"; but any special size to meet your requirement can be made. The 6" unit is suggested for either plant inspection uses or—as a portable unit for the trouble shooter or the salesman where a large aperture, compact unit of light weight is desirable.

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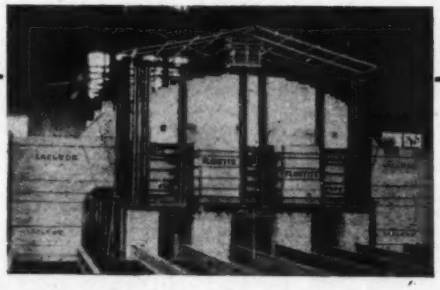

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